UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF COMMERCIAL FISHERIES

CALIFORNIA FISHERY MARKET NEWS MONTHLY SUMMARY

MAY 1969

PART II–Fishing Information*

Sea-surface temperatures, fishing and research information of interest to the West Coast tuna-fishing industry and marine scientists

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U. S. Department of the Interior
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P. O. Box 271
La Jolla, California 92037

*Part 1 - "Fishery Products Production and Market Data" is issued by the Bureau of Commercial Fisheries, Market News Service, U. S. Custom House, Terminal Island, California

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TEMPERATE TUNA FORECAST FOR 1969

The following paragraphs comprise the ninth consecutive annual prediction to be issued for the summer season albacore and bluefin tuna fisheries off the Pacific coast.

Long-time subscribers to this publication will note that the forecast statements are 3-4 weeks later than usual this year, and that the basic format and content of the statements which follow have been appreciably altered in comparison with earlier years. Last year's experience further confirmed our previous position that short-term environmental trends in summertime tend to override or obscure long-term trends. Without essential biological data for albacore and bluefin, we continue to be in a difficult position to make meaningful long-term (seasonal) projections having the desired accuracy and substance.

In the past year, our staff has made few new advances in the areas of environmental monitoring and biological prediction. Those improvements that have been made reside in the areas of: refining ship-shore communications media (e.g., prototyping shipboard hardware, planning the relocating of WWD transmitters, and establishment of hardwire telecommunications links with the U.S. Coast Guard, and ESSA-Weather Bureau); environmental data processing and tabulation; and completion of the updating of our unique 15-day long-term mean sea surface temperature charts and their graphical differentials. No additional gains have been made in the major problem areas of estimating year-class strength, apparent abundance, and fishing effort for albacore and bluefin tuna. The continued application of restrictive measures within the Federal Government has hampered the orderly growth and progress of the work which the Fishery-Oceanography Program staff recognizes as both necessary and relevant to fishery forecasting problems.

Pre-season scouting information remains absolutely essential to the successful forecasting of the onset of the albacore and bluefin tuna season. In 1968, R/V DAVID STARR JORDAN was the only vessel at sea a sufficient length of time off southern California to scout for albacore tuna. JORDAN's catch on June 12 heralded the first verified arrival of albacore on the southern California feeding grounds and provided evidence, which was later substantiated, that the fish were approximately 2-3 weeks earlier than in the 1965-67 period. Without substantial additional information and research effort on the mechanisms influencing the timing of the onset of migration and arrival, albacore and bluefin tuna scouting expeditions remain vital to the formation of judgments about early-season conditions.

This year, R/V JORDAN will occupy the California Cooperative Fishery Investigations Marine Life Research anchovy-sardine survey grid lines up to about 150 miles offshore. JORDAN's southbound trip commencing on June 9 will permit a trolling survey of the district from San Diego WSW to about 150 miles offshore, and thence southward to below Guadalupe and Cedros Islands. On July 10, JORDAN will work the northbound portion of the survey grid extending from Point Conception to San Francisco and offshore 80-120 miles. The ship's staff will troll for albacore in all waters warmer than 59° F during daylight hours.

The Oregon State University vessel R/V CAYUSE will occupy survey lines covering the nearshore district from Newport, Oregon, southward to the Coos Bay-Brookings area and thence offshore up to 240 miles, commencing June 26 and ending July 3. R/V YAQUINA is also scheduled to survey the offshore district from Newport, Oregon, north to the mouth of the Columbia River and offshore up to 200 miles. The first cruise, scheduled for June 18-July 3, will probably be somewhat early, but the second cruise, slated for the July 30-August 13 interval, should provide essential information at the time when the Oregon fishery is expected to be in full-scale operation.

In addition, the Fish Commission of Oregon plans to let a charter contract for about 10 days scouting time off the Oregon coast commencing in the first week of July. Consequently, Oregon and northern California waters promise to be the best-scouted in recent years, whereas the southern California district will receive limited coverage at best. All fish reports from these vessels (negative as well as positive) will be incorporated into our WWD daily albacore advisory broadcasts as soon as practicable upon receipt.

Thus, we plan to continue the pattern of operations established last year. Long-term landings and area forecasts will be replaced by short-term projections based on current information. Frequent use will be made of our successful bulletin series, and these will be issued and numbered consecutively as often as the situation warrants. These bulletins will include: atmospheric and oceanographic trends; locations of productive fishing areas; changes in market and unloading conditions which may affect effort; and other data as are appropriate. Outlook statements will be prepared to give the fishing and processing communities our best estimates of projected trends. As has been stated often in previous years, the success of the program depends upon the input of timely, first-hand information from fishermen at sea, as well as dock operators and processors. We cannot understate how seriously insufficient information restricts the quality and timeliness of our advisory materials.

Radio communications problems will be partially resolved this year. Oregon State University, in cooperation with BCF and NASA, will be operating a radio advisory service through the Marine Operator in Astoria, Oregon, (see next article for details). Our laboratory plans to forward by teletype the actual text of our WWD

broadcast to Oregon, where it will be abridged and altered, if desirable, with new local information. Thus, boats not having transceivers able to copy frequencies as high as those used by WWD at La Jolla will have access to at least part of the information gathered at the Fishery-Oceanography Center in addition to that collected at Newport and Corvallis, Oregon.

Albacore Tuna

The high correlation between catch and sea temperature, combined with 9 years of experience in summarizing and observing changes in sea surface temperature fields over 15-day intervals, provide the basis for plates 1 and 2. In plate 1, the mean position of the limiting isotherm, 60° F, is depicted as of May 16-31, 1969 (solid line). In addition, for comparison, the 9-year average position of this isotherm is also depicted (dashed line). It appears that early-season warming has already started the northeastward advance of the 60° F isotherm in the area lying between latitudes 31-36° N and longitudes 123-135° W. This rapid movement is associated with large-scale warming resulting from greater-than-normal in-situ (local) heating and a reduction in the normal advective components in this district.

The area outlined above is a critical region in our view. Since 1960, pre-season cruises of BCF R/V BLACK DOUGLAS and California Department of Fish and Game R/V N.B. SCOFIELD have found migrating albacore in this district at about the same time each year. Since the conditions now being observed are similar to those at the same time last year, it is probable that significant numbers of fish may turn northward as the 60° F isotherm continues to accelerate its northeastward advancement.

The shaded zone in plate 2 illustrates the 9-year average position of the optimum-temperature zone for the July 1-15 interval. If this interval in 1969 were to be "average", one would expect to find the bulk of the albacore to be taken from this zone. However, since prevailing weather will doubtless alter sea temperature patterns, deviations from this general pattern are to be expected. We plan to modify and update our projections of the location of this zone as conditions indicate.

Climatological conditions over the eastern North Pacific from February to May have shown significant departures from normal. The eastern North Pacific high pressure cell is less intense than usual, and the sea level pressure field is about one standard deviation below normal. Wind fields associated with the eastern side of this system have been weak, and resultant wind flow in the 30-40° N latitude band shows an accelerated west-to-east surface current flow as far as 165° W

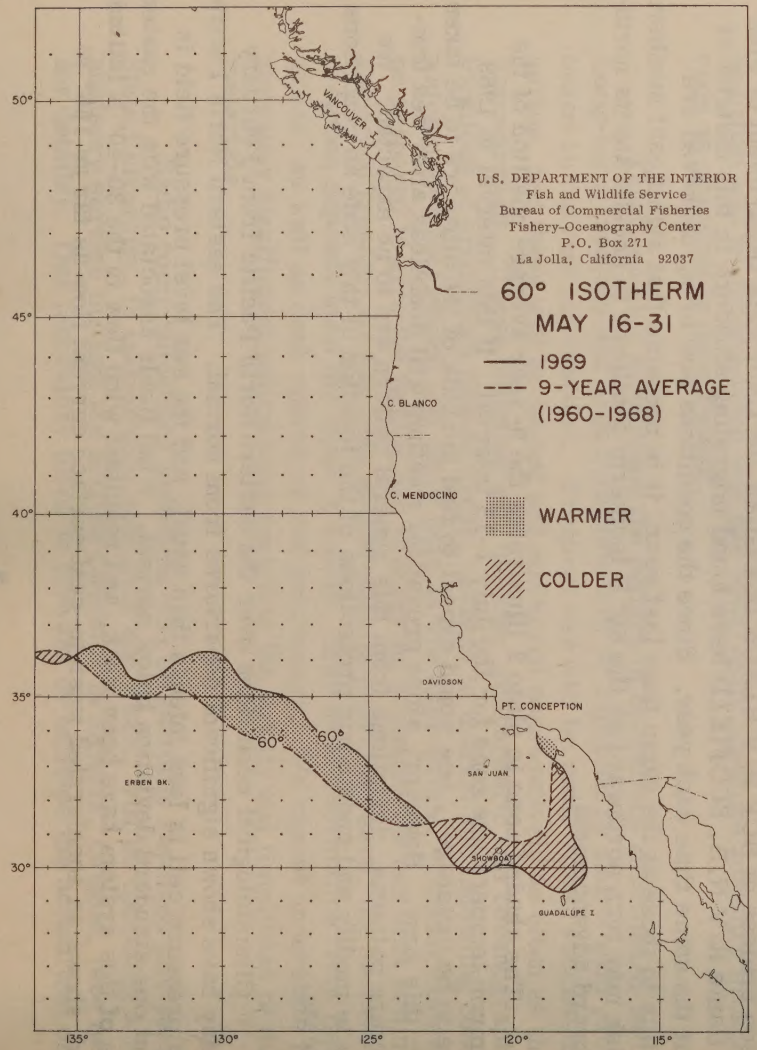


Plate 1.--Relation of position of May 16-31, 1969, 60° F limiting isotherm to long-term average position for the same interval.

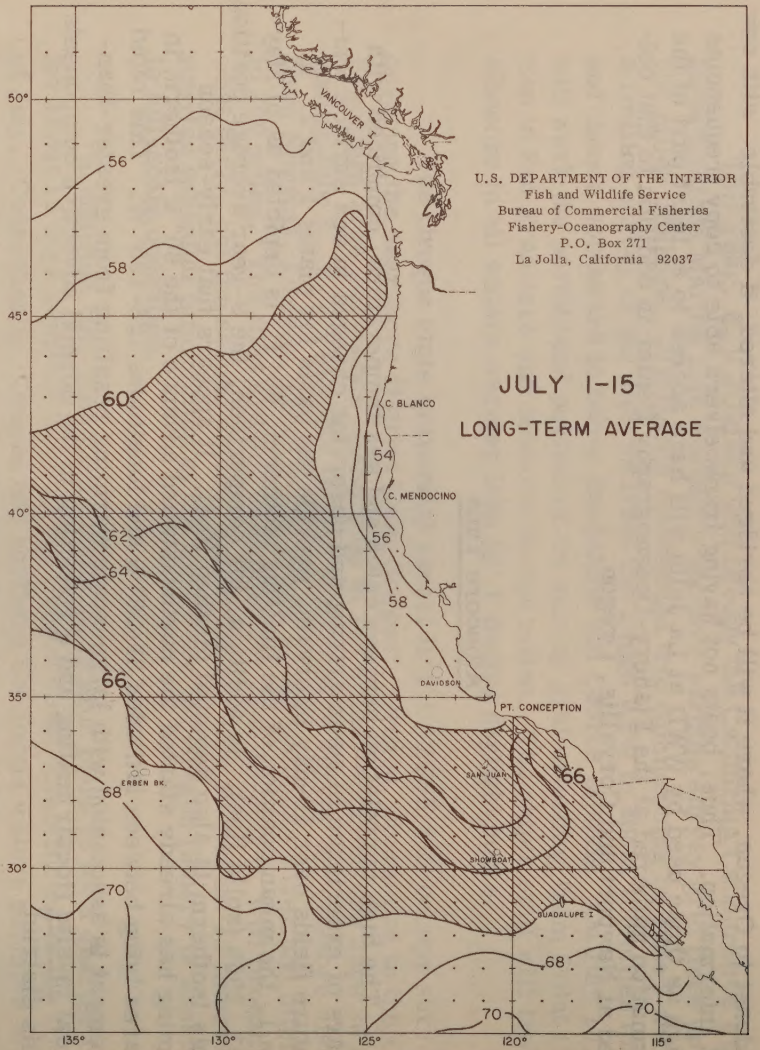


Plate 2.--Average sea surface temperature fields for the July 1-15 interval. Shaded zone delineates region where most of the albacore would be available under these conditions.

longitude. Migrating albacore moving through this vast district could well "ride" this current field and appear in U.S. west coast offshore waters early.

Nearer to shore, conditions have differed substantially from previous years. The California coast north of Point Conception has experienced less intense northwesterly wind flow, and major upwelling pulses, normally evident by mid-May, have not occurred. Consequently, inshore temperatures are appreciably higher, and the areal extent of the "green water" (the result of the exposure of cold, nutrient-rich deep waters to light) is expected to be substantially smaller than normal. Albacore can thus be expected to penetrate closer to shore this year in warm "blue water" unless upwelling should accelerate during late June-early July period. One consequence of a less intense pressure gradient and wind field near shore would be easier access to fishing grounds in the Point Conception-Cape Mendocino district, an area often too windy to fish, even though albacore are present.

July landings in California should improve over last year when a new low of 328,000 pounds was established. In contrast, Oregon's 8-million pound record was the first time landings in that state had exceeded California's since 1941.

One factor which may serve to reduce July landings totals in California is a late fish price settlement. If an agreement is reached early, many boats will commence operations in southern California waters and land their fish locally; if the price settlement is delayed, these boats will move northward and commence operations much the same as last year. Thus, a delay will adversely affect California landings and cause significant alterations in fishing strategy, as well as major dislocations in ports where fish will be delivered.

Nevertheless, we do not expect July landings in California to rise as high as the 1940-67 average of 6,675,000 pounds. The Guadalupe area, formerly a major contributor to the California early-season totals, is not expected to yield much in 1969. Fish have appeared in late May-early June in this district during the early 1950's when cold water conditions prevailed. Sea temperatures already exceed 62-64° F as of May 31, and are expected to exceed 66° F by mid-July if present warming trends continue.

U.S. west coast production trends since 1940 show a gradual average increase each decade from 34 million pounds in 1940-49 to 45 million pounds in 1960-68. In addition, the variance of that production has declined from 22 million pounds in the former interval to only 8 million pounds in the latter. Since 1963, when our fishery advisory services began to be widely used by the fishing community production has averaged 48 million pounds. Thus, according to the 1963-68 average, from 40-56 million pounds could be landed this year.

If the Pacific Northwest region should receive up to 75% of the total U.S. west coast landings (as it did last year), then California could expect to receive from 10-14 million pounds at the minimum, and Oregon-Washington would receive

from 30-42 million pounds at the maximum. Conversely, if Oregon-Washington and California each collectively receive 50% of the total landings, then from 20-28 million pounds would be tallied. Taking into account the foregoing trends and our interpretation of present operational limitations and economic implications affecting fishing effort this year, we estimate that from 15-21 million pounds may be landed in California and 25-35 million pounds would be landed in Oregon-Washington.

Bluefin Tuna

Final bluefin landings totals for 1968 came to slightly more than 12,936,000 pounds (6,468 tons). This was the second year in a row that bluefin production was off sharply, and was significantly below the 1961-66 production average of 13,000 tons even though considerable fishing effort was expended. The late start of the 1968 fishery was attributed to a period of strongly northerly winds in the Baja Californ district in late May-early June and consequent upwelling of cold, green water in a wide zone near shore. In addition, dislocations in potential fishing effort occurred as a result of the fixing of the yellowfin tuna season closure on June 18, 1968.

This year, bluefin were first taken on April 24 in the region southwest of Uncle Sam Bank off lower Baja California. Approximately 300-400 tons were taken in the initial flurry of activity, setting one of the earliest opening dates for the bluefin tuna purse seine fishery in this district in several years. Since that time, windy weather and good yellowfin fishing south of Cape San Lucas have diverted potential fishing effort temporarily. No significant catches have been reported for over 2 weeks, except for one calm interval on June 1 and 2 off Magdalena Bay, where approximately 500 tons were taken.

Sportfishing partyboat operators have reported taking a few small bluefin in the area southwest of the Coronados Islands off San Diego in the first week of June; this occurrence suggests that bluefin may enter the southern California district the earliest in several years.

Oceanographic trends in the region south of Punta Eugenia indicate early-season warming which is evident over a large inshore district off the Baja California coast. This warming, combined with reduced upwelling in the near shore districts from Point Conception south to Punta Eugenia, should bring about favorable sea temperature conditions for bluefin by the middle of July.

Bluefin tuna landings could register a sharp increase this year--IF the fish are as abundant and readily available as they were in 1966 when a record 17,500 tons were produced. An all-time high in fleet capacity is now at sea fishing on closed tickets since establishment of the yellowfin tuna season closure on April 16, 1969. Since the bluefin grounds lie conveniently close to San Diego, we expect most boats to devote an appreciable amount of effort to bluefin if they show in numbers.

One major consequence of this situation will be a sharp jump in bluefin tuna production when the boats locate fishable concentrations. The accessible bluefin stocks will thus be subjected to some of the most concentrated fishing effort to be witnessed in many years. As much as one-half of the estimated 24,000 capacity tons now at sea could be directed to bluefin if conditions so warrant. Since a great deal of interest will be directed to bluefin tuna this year, we plan to broadcast pertinent information as is appropriate on the WWD frequencies serving the albacore fishing community.

Total season production estimates still are impractical. Until we can develop some means of estimating abundance, and are able to make pre-season surveys to help determine early-season availability, we cannot provide meaningful predictions. Meanwhile, we propose to expand our activities along the lines of the albacore program wherein we monitor changing conditions as closely as possible and report them to the fleet.

June 10, 1969

Staff, Fishery-Oceanography Program
Glenn A. Flittner, Leader

ALBACORE SEASON--1969 OPERATIONS

Radio station WWD, licensed to the Bureau of Commercial Fisheries and located on the campus of the Scripps Institution of Oceanography, University of California at San Diego, will resume its broadcasts of albacore fishery information again this year. Double sideband voice broadcasts will emanate from WWD twice daily during weekdays only from June 23-October 31 on frequency 4415.8 kcs and at 0500 PST (0600 PDST) and 1945 PST (2045 PDST). Single sideband (SSB) broadcasts can be copied on 8805.6 kcs and 12,403.5 kcs by those boats having SSB equipment. Curtailment of funds and personnel resources continues to prevent the development of an adequate broadcast updating system for weekends and holidays.) Broadcasts will include the latest albacore information obtained from research vessels, cooperating fishing vessels, unloading station operators, and will contain sea temperatures and other pertinent weather information believed useful to albacore fishermen.

In addition, at the end of each 15-day calendar period, the Fishery-Oceanography Center will encode and prepare for transmission (twice daily for two consecutive days) the coordinates for the 60- and 66-degree isotherms from the 15-day sea surface isotherm charts which are routinely mailed to about 800 readers. Coordinates will be given for the region east of 130° W longitude and 30-50° N latitude.

Sample Broadcast

"Daily albacore fishery information, September 30, 1968

Fishing information:

California--Several jigboats reported good scores of up to 300 fish on September 29 between Loran Lines 1800 and 2000 on 2 Howe 2 6-7 hours offshore. Calm weather reported in this area, off Morro Bay, with 61 degree water. Almost all boats are out today with this break in weather.

Oregon--Astoria is swamped with fish today. About 750 tons of albacore are at dockside Astoria. About ½ this amount is jigfish the other half baitfish. Rough seas is the primary reason for this influx of fish. Halibut schooners are still fishing in spite of seas. Some California boats have returned to the northern fishery and are starting to re-appear in Oregon ports.

Weather summary:

Low pressure system over Alaska peninsula Friday has moved northward and filled over weekend. Most of U.S. west coast under influence of weak trough of low pressures Monday, bringing marine flow in most coastal regions. Small cell of high pressure 1024 millibars west of Vancouver Island is associated with narrow ridge extending southwestward to large intense high pressure system over the western Pacific. High pressure cell off Vancouver expected to intensify and trough of low pressure over U.S. west coast to remain through Tuesday.

Washington and Oregon--Light-moderate northwesterly winds with slight to moderate seas Monday. Not much change expected Tuesday.

Northern and central California--Moderate southerly winds with slight-moderate reported inshore Monday. Not much change expected Tuesday.

Southern California--Light-variable winds with slight seas reported offshore Monday. Not much change expected Tuesday.

Map coordinates of 15-day chart ending Sept. 30, 1968 covering region east of 130W long and 25-50N lat. Message coded as follows:

First 3 numbers are lat in degrees and tenths.
Last 4 numbers are long in degrees and tenths.

Message:

Position of 60-degree isotherm	Position of 66-degree isotherm
4751300	4051300
4731292	4031294
4761277	3961290
4731263	3821290
4601247	3531259
4551244	3461248
4271256	3301240
4171257	3181215
3831251	3031195
3671245	3031186
3531230	3041182
3501220	3101181
3401209	3301184
3401205	3341186
3421202	

Outlook:

Fall cooling commencing Pacific Northwest offshore region indicating onset southward movement 60-degree isotherm. Resumption stormy weather will accelerate heat loss from upper mixed layer in area north of 40th parallel. Expect albacore to commence offshore migration near mid-month after sea temperatures commence sharp drop Oregon-Washington region. California waters may produce late-season action Cape Mendocino to Point Sur area as long as good weather prevails.

BCF FOC, La Jolla
(End of broadcast.)"

The above message, when decoded and plotted as in the example following this section, provides the fisherman at sea with a current analysis of the 60-66° F temperature zone (from which more than $\frac{2}{3}$ of the total Pacific coast albacore landings have been produced in recent years). In addition, a summary of the Fishery-Oceanography Center staff's best estimate of what is expected to happen in the succeeding 15-day period will be included as in the sample above.

To make the advisory broadcast fully effective, the Fishery-Oceanography Center requires timely information from all sources at sea and ashore. To provide a medium for communication of oceanographic and current fishing data, radio station WWD will operate on the following frequencies and scheduled times:

Voice only	Telegraph only
4,415.8 kcs	4,262 kcs
8,805.6 kcs	8,698 kcs
12,403.5 kcs	12,871 kcs
16,533.5 kcs	17,105 kcs
22,079.5 kcs	22,419 kcs

Hours of Operation: Unlimited as requested, normally 0400-0100 local time 7 days per week, including holidays.

Class of Traffic: As approved by Radio Station WWD. Inter-ship operation, other than for relay of traffic and scientific exchange of data, is not authorized.

Boat operators interested in participating to provide information services directly to WWD are requested to write to

Director
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037

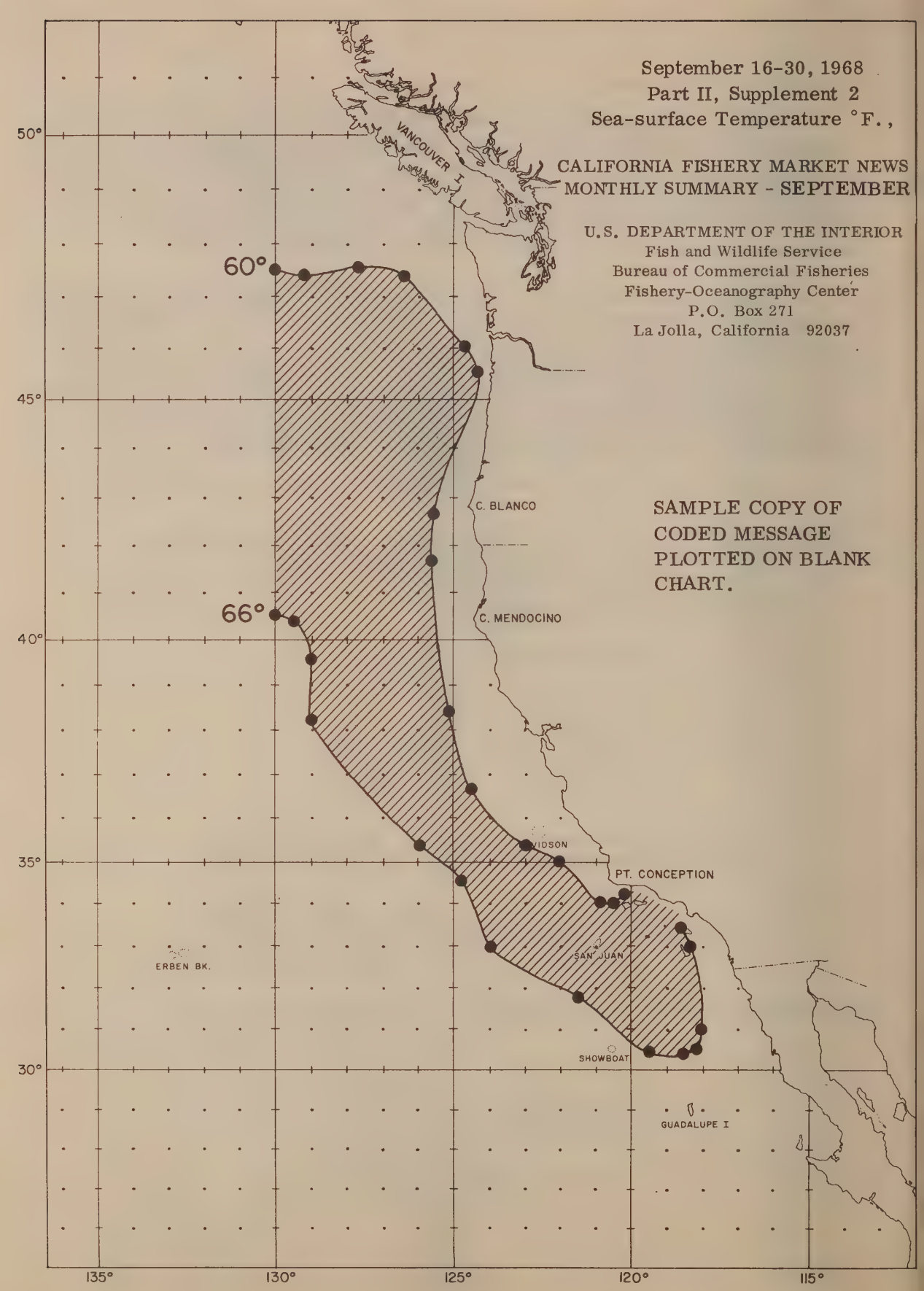
for further details.

Fishermen operating in Oregon-Washington waters this year also will have additional radio advisory materials made available to them through a joint cooperative project between BCF and Oregon State University. Oregon State University (OSU) will operate an albacore information service this summer. Like La Jolla's, it will emphasize sea surface temperatures. OSU, however, will concentrate on microscale features along the Oregon coast out to 200 nautical miles.

Present plans are for OSU to transmit a daily message through the Astoria Marine Operator from July 1-October 1, 7 days a week. These messages will be part of the normal weather broadcast at 1015 PDT and 2215 PDT. Each message will be run twice; the new message will be the evening message. In addition to using information from La Jolla and the Weather Bureau, OSU will receive reports from aircraft equipped with infrared thermometers, from research vessels, and from fishing boats (11 have been outfitted with bathythermographs).

June 10, 1969

Staff, Fishery-Oceanography Program
Glenn A. Flittner, Leader


September 16-30, 1968
Part II, Supplement 2
Sea-surface Temperature °F.,
CALIFORNIA FISHERY MARKET NEWS
MONTHLY SUMMARY - SEPTEMBER
U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037
SAMPLE COPY OF CODED MESSAGE PLOTTED ON BLANK CHART.
60°
66°
VANCOUVER I.
C. BLANCO
C. MENDOCINO
VIDSON
PT. CONCEPTION
SAN JUAN
SHOWBOAT
ERBEN BK.
GUADALUPE I
50°
45°
40°
35°
30°
135°
130°
125°
120°
115°

SUPPLEMENTARY FISHERIES

Small vessel owners may be interested in a couple of fisheries that have been established within the last year. Both were initiated with the aid of the Bureau of Commercial Fisheries, and could provide supplemental income for vessels which presently do not fish throughout the year.

Basking Shark Fishery

A fishery for basking sharks existed in California in the late 40's and early 50's. The object was the liver, from which industrial oil was extracted. The fishery ended when the price of industrial oil dropped. Last year, the fishery was reactivated, but this time the object of the fishery is squalene, a compound found in the liver oil, and used extensively in the cosmetic field. The major source of this compound is shark liver oil, principally from basking sharks, but also from some deep water species of sharks. Norway, which landed 4.5 million pounds of basking shark liver in 1967, is presently the leading producer.

Last year, five vessels working intermittently landed about 50 tons of basking shark liver at Santa Barbara and Avila Beach. Many more tons could have been landed, if vessels were available near areas of seasonal abundance of sharks. This year, the fishery has expanded northward, and several tons of liver have been landed at Moss Landing in May.

Basking sharks attain a length of 30 feet, and weigh up to 3-4 tons. The liver makes up 20-25% of the total weight; average liver weight for over 50 sharks taken off California was about 1150 pounds.

Little is known about the behavior, distribution, and abundance of basking sharks. They show up seasonally in many areas between Monterey and Santa Barbara, usually close to shore and in bays. The sharks are usually found in small groups, but one airplane spotter estimated that he has observed as many as 2000 sharks in a single group.

Fishing methods used to handle these huge animals are rather simple: the sharks are harpooned and shot, then livered at sea. Under good conditions the entire operation takes 15-20 minutes. More than 20 drums (4 tons) have been landed by a single boat after 1 day's fishing.

Fishermen and vessel owners interested in entering the fishery should contact the buyer: Ruda's Seafood, Avila Beach, California 93424; telephone (805) 595-2044.

Swordfish

California swordfish landings have never exceeded 250 tons since the peak year of 1948, when 550 tons were landed; the 1967 catch was 152 tons. Swordfish formerly were caught exclusively by the harpoon method, which requires good weather conditions and availability of fish on the surface and near the California coast. These requirements restrict fishing to about 4 months, from July through October.

On the Atlantic coast, longlining has virtually supplanted the harpoon method, and both Canadian and American landings have increased since the introduction of longline gear.

Since 1964, Japanese longliners have fished off the Baja California coast, and have made good catches of swordfish during certain months. In November 1968, BCF's research vessel DAVID STARR JORDAN made a longline cruise to southern Baja California to confirm the presence of swordfish and to show that they could be caught by longline. Twenty fish were caught by JORDAN, using a total of only 2000 hooks. This represents a hook-rate of 1%, which, because of the high price of swordfish, makes it entirely feasible to fish swordfish with longline. For example, a commercial vessel could set about 8000 hooks during a 2-week trip. A 1% catch rate would yield 80 fish, or about 6 tons of dressed fish.

Methods evolved by BCF, incorporating ideas borrowed from the Japanese, Canadian, and U.S. swordfish longline fisheries, allow four men to fish 500 to 1000 hooks per day, depending on the abundance of fish and sharks. The gear features a powered reel to haul and store the mainline, and detachable dropper lines.

Two vessels from Morro Bay, BLUE BELLE and RON H. have made longline trips this year, using BCF-loaned gear and methods. Although both vessels fished during periods of low abundance of swordfish, they managed to catch 45 fish. From present evidence, it is likely that the best time to fish swordfish is from September through January.

Fishermen interested in the longline method or details of the cruises made to date should contact:

Director
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037

June 10, 1969

Susumu Kato
Fishery Biologist
Operations Research Program

INCIPIENT EL NIÑO MONITORED OFF SOUTH AMERICA

Recent reports from Peru and Ecuador coastal stations have indicated that sea temperatures have risen rapidly in the past 4-5 months. Anomalous temperature increases of up to 2° F have been reported at Puerto Chicama, Peru and La Libertad, Ecuador in April-May.

The most significant aspect of these sharp temperature rises is that conditions have shifted rapidly from below normal to much above normal. The entire region from the equator to 15° N also exhibits above-normal conditions (see Figure 6 of this publication). Although our data field for the open sea to the south of the equator is extremely sparse, it is already evident that a vast offshore district from the equator southward to about 15° S is generally more than 2° F warmer than our 9-year average base, and that climatological conditions are indeed similar to those observed early in 1965 when the last El Niño was first observed. Open ocean conditions west of the Galapagos Islands in May, 1969 are as much as 4° F warmer than normal.

We plan to follow the development of El Niño conditions very closely over the next few months, and will attempt to provide interpretive statements whenever we obtain sufficient information on which to base substantive conclusions.

June 10, 1969

Staff, Fishery-Oceanography Program
Glenn A. Flittner, Leader

SEA SURFACE TEMPERATURE CHARTS, EASTERN PACIFIC OCEAN
MAY 1969

Acknowledgements

The following organizations and stations contributed data for the May 1969 charts:

U.S. Bureau of Commercial Fisheries Biological Laboratories La Jolla, California, Honolulu, Hawaii and Seattle, Washington
U.S. Coast Guard Cutter ACUSHNET
U.S. Naval Weather Service, Fleet Numerical Weather Central, Monterey, California
Environmental Science Services Administration
U.S. Weather Bureau, San Diego, California
U.S. Coast and Geodetic Survey, Pacific Marine Center, Seattle, Washington
Global Marine Inc.; GLOMAR CHALLENGER
Hopkins Marine Station, Pacific Grove, California, J. P. Balesteri
Inter-American Geodetic Survey by David Ortega at Manzanillo, Mexico; R. H. Peren at Pt. Armuelles, Panama; V. E. Castillo at Tumaco, Columbia; S. Valenzuela at La Libertad, Ecuador; O. Rodriguez at Talara, Peru; Pedro Chauca at San Juan, Peru; Arica, Antofagasta, Caldera, Valparaiso, Talcahuano, Chile, through the courtesy of St. Hellmuth A. Sievers C. at the Instituto Hidrografico de la Armada, Valparaiso, Chile
Instituto de Fomento Pesquero, Santiago, Chile; R/V CARLOS DARWIN
Kelco Company, San Diego, California
Matson Navigation Company, San Francisco; S. S. CALIFORNIAN
Pacific Missile Range, Range Operations Department, Geophysics Division Point Mugu, California
Pacific Oceanographic Group, Nanaimo, British Columbia, by H. J. Hollister from observations by G. C. Wilks at Langara Island Light; C. Olsen at Cape St. James Light; Lily Collins at Kains Island Lightstation; O. A. Edwards at Amphitrite Point Light.
Scripps Institution of Oceanography, La Jolla, California by Margaret Robinson and Hans Klein
Scripps Institution of Oceanography Research Vessels; ALEXANDER AGASSIZ, ARGO, FLIP, ELLEN B. SCRIPPS, THOMAS WASHINGTON
Van Camp Sea Food Company, Division of Ralston Purina Company, Terminal Island, California
W. R. Grace and Company, New York by Dr. I. William Lane
Fishing Vessels; MARTINAC, WESTPORT, CONCHO, MISSOURI, LOIS SEAVER UNITED STATES

Charts

Figure 1.--Mean sea surface temperatures (° F) derived from approximately 8000 observations. Squares show temperatures at weather ship stations. Numerals on shore are temperatures at coastal and lightship stations.

Figure 2.--Deviation of sea surface temperatures (° F) from long term charts of H. O. 225. Hatched areas are colder in 1969.

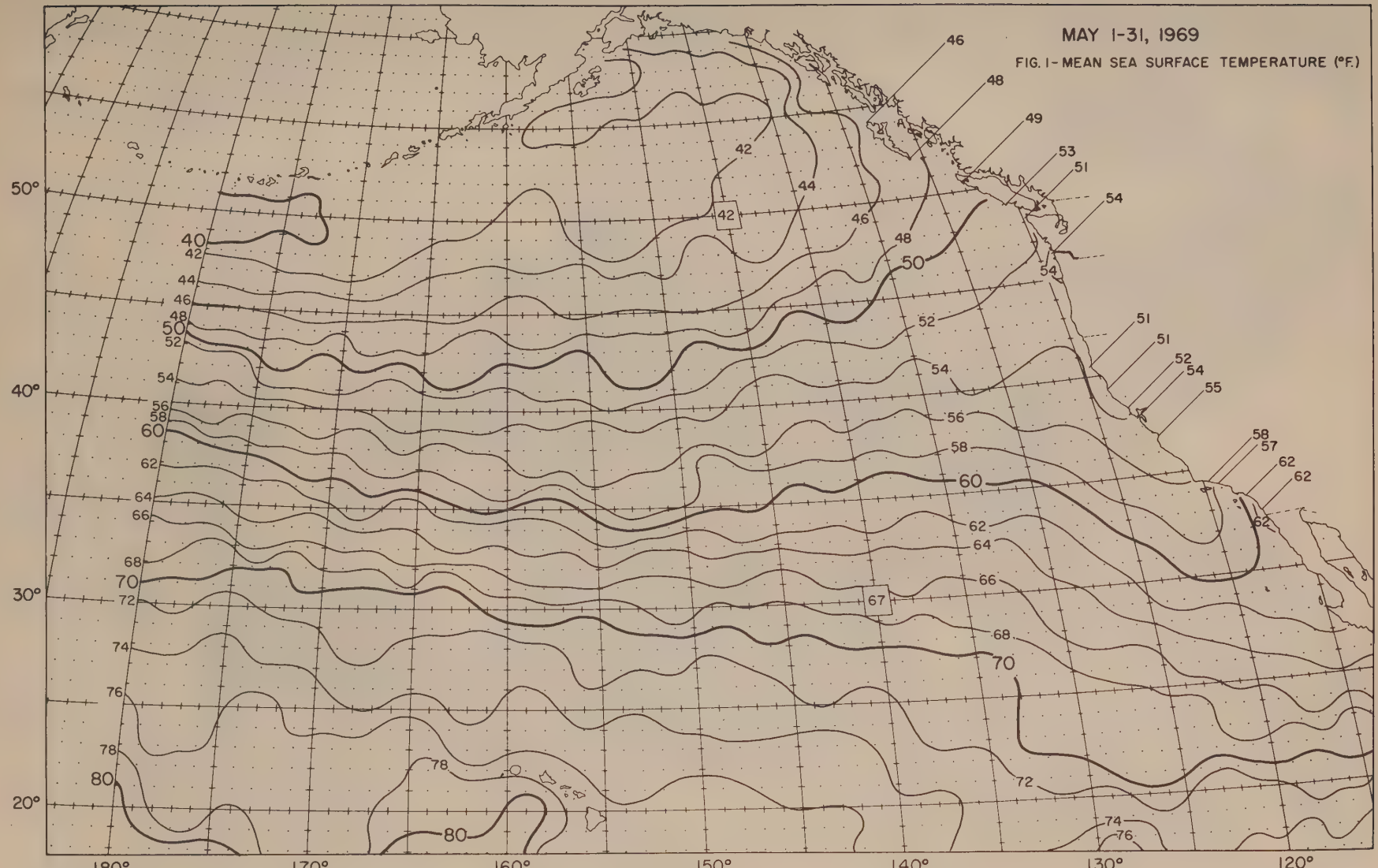
Figure 3.--Deviation of sea surface temperatures (° F) from those of May 1968. Hatched areas are colder in 1969.

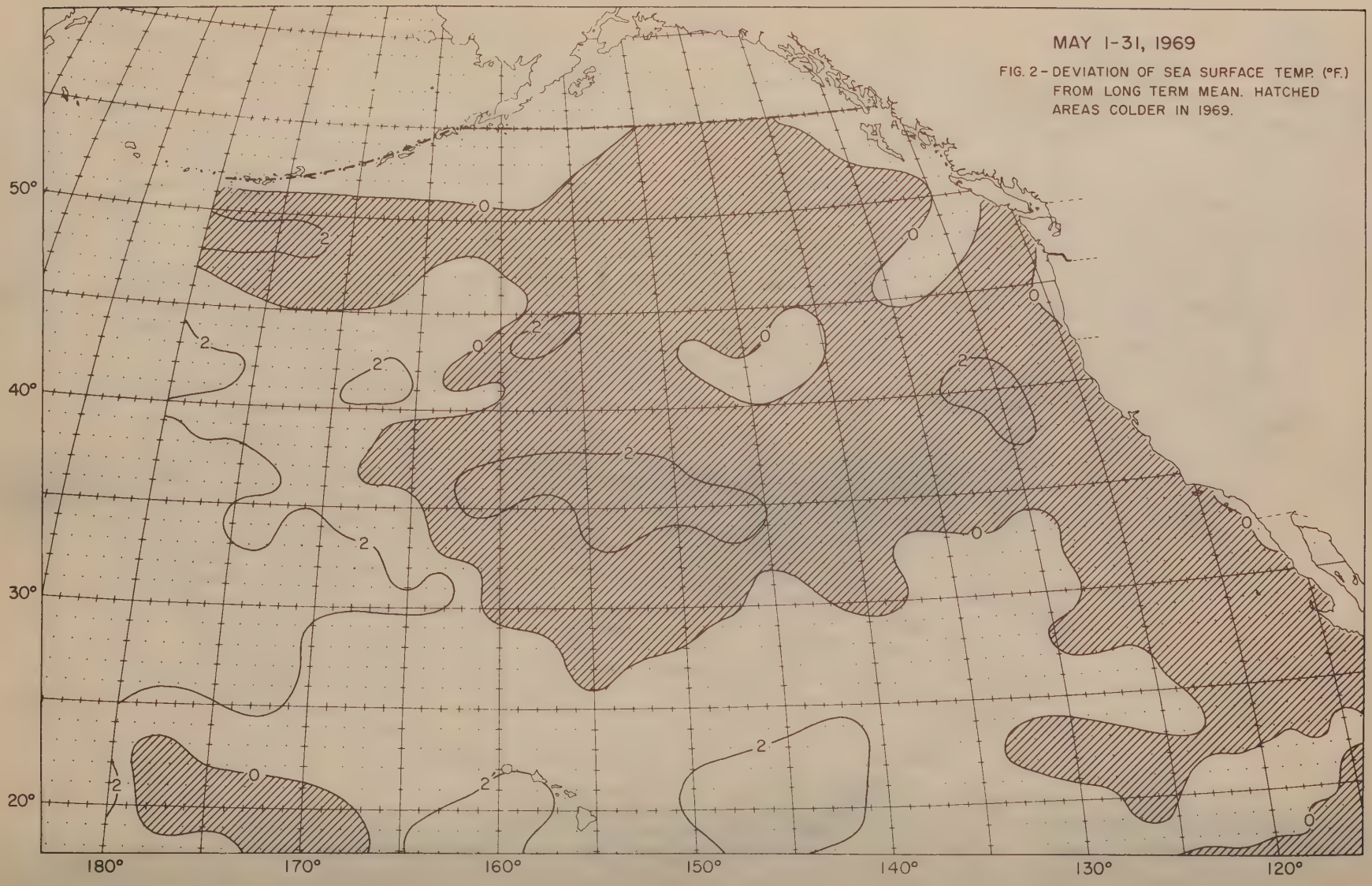
Figure 4.--Sea surface temperatures (° F) by 1-degree squares, approximately 2000 observations. Line under temperatures indicates average of two or more observations. Numerals on shore are temperatures at coastal stations.

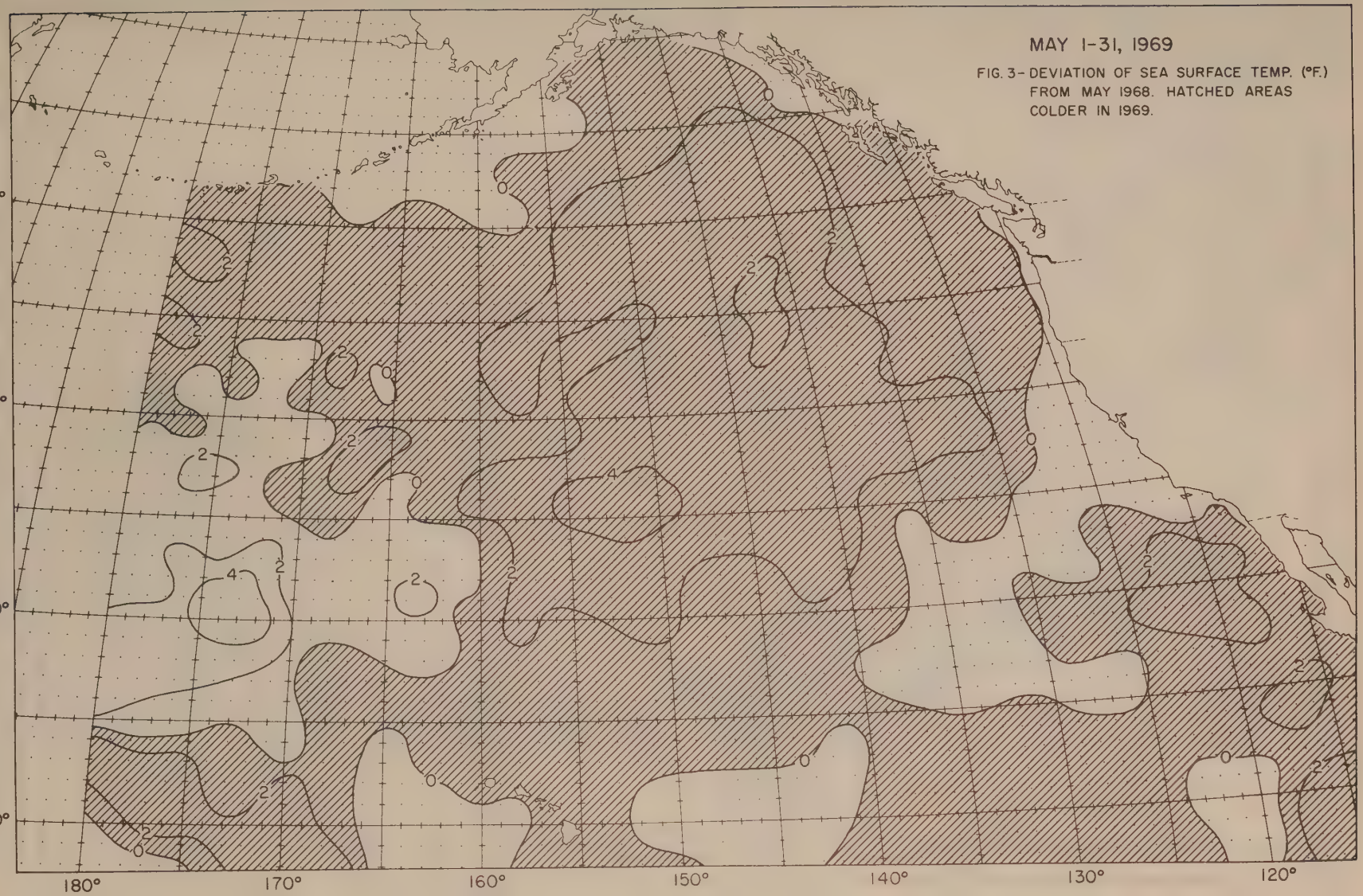
Figure 5.--Deviation of sea surface temperatures (° F) May 1969-May 1968 by 1-degree squares. Shaded areas are colder in 1969.

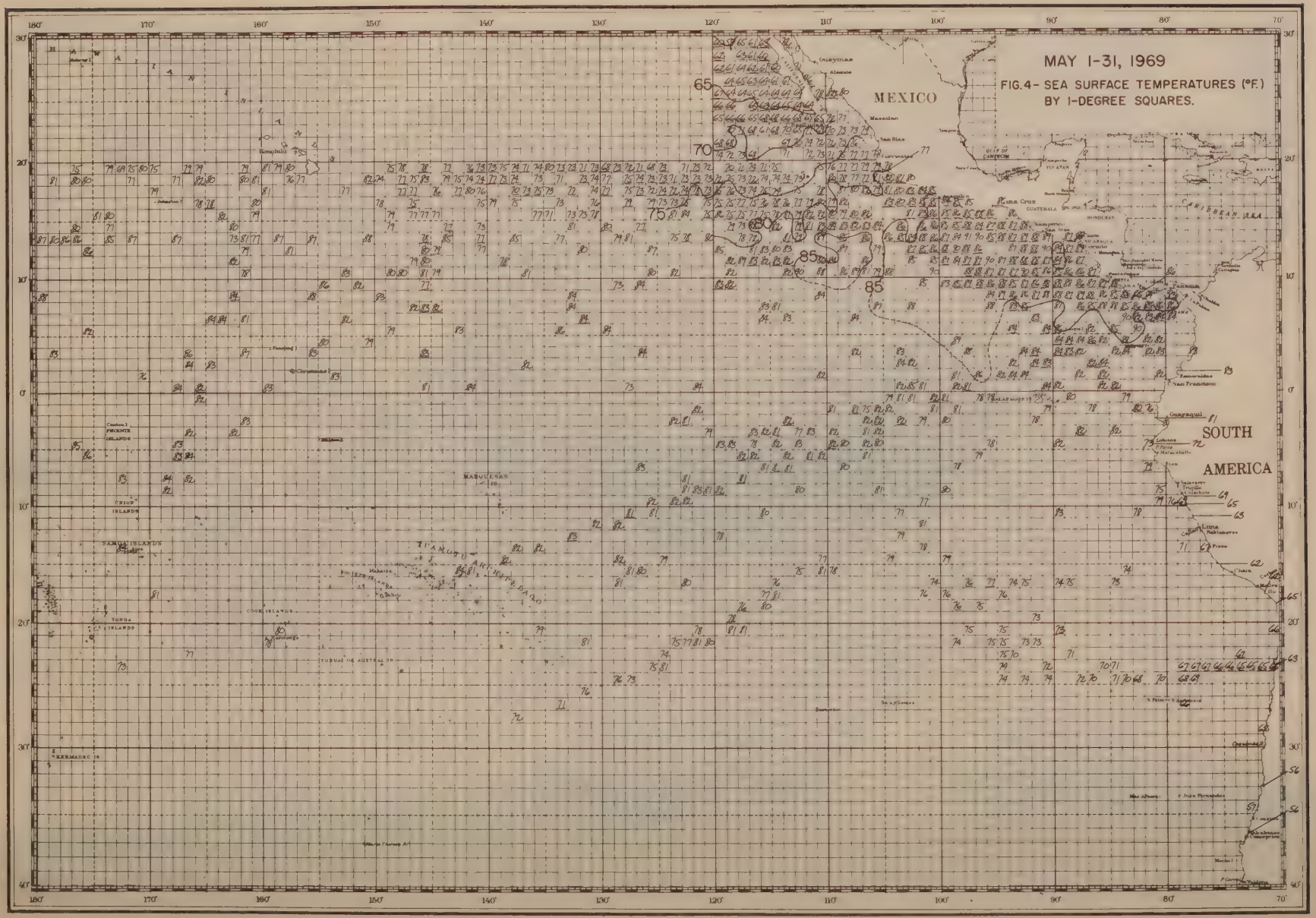
Figure 6.--Deviation of sea surface temperatures (° F) from 12-year mean (1947-1958) by 2-degree squares. Shaded areas are colder in 1969.

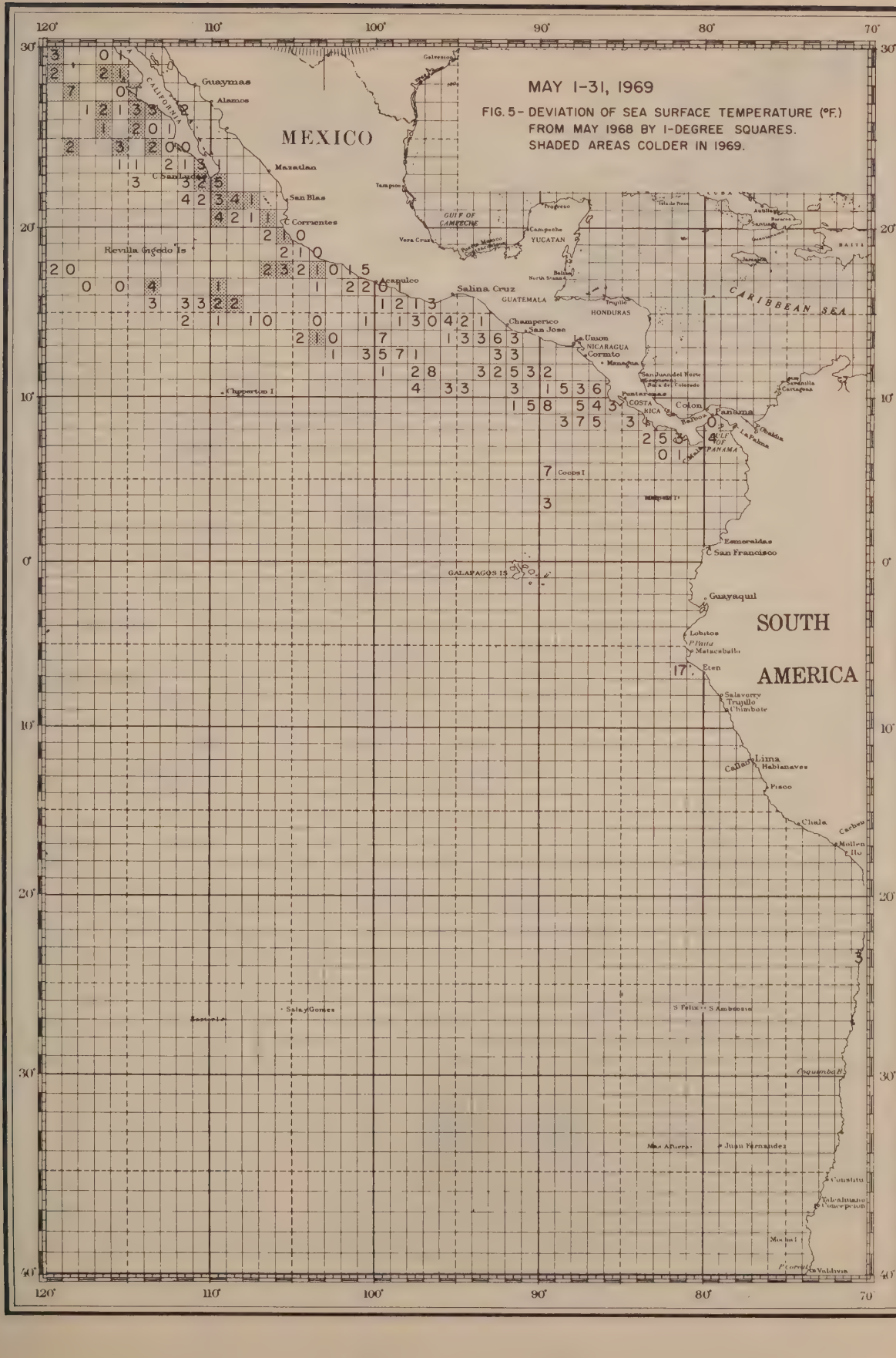
James A. Renner, Fishery Biologist
Kenneth S. Raymond, Scientific Illustrator
June 5, 1969

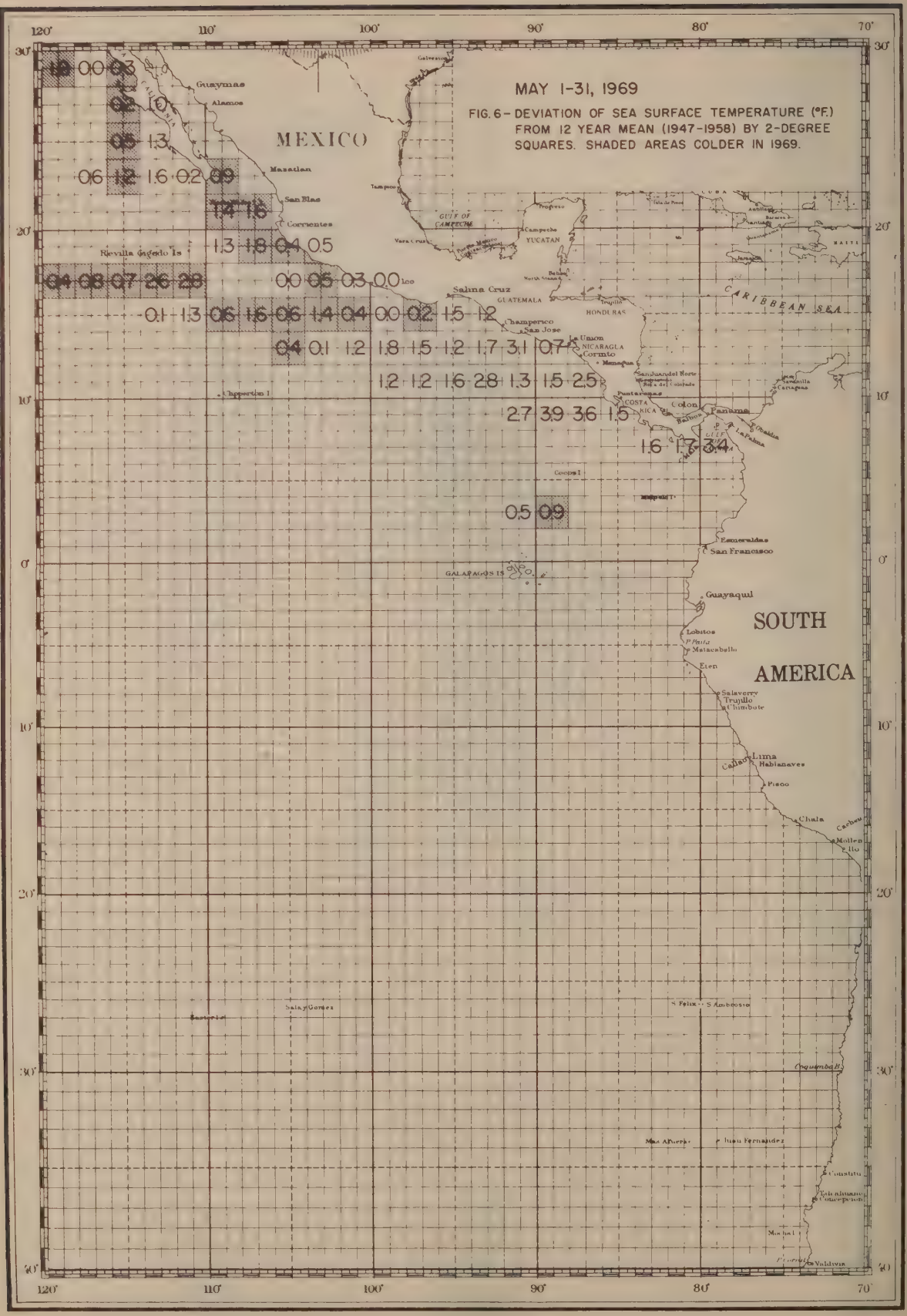

MAY 1-31, 1969
FIG. 1 - MEAN SEA SURFACE TEMPERATURE (°F.)
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°

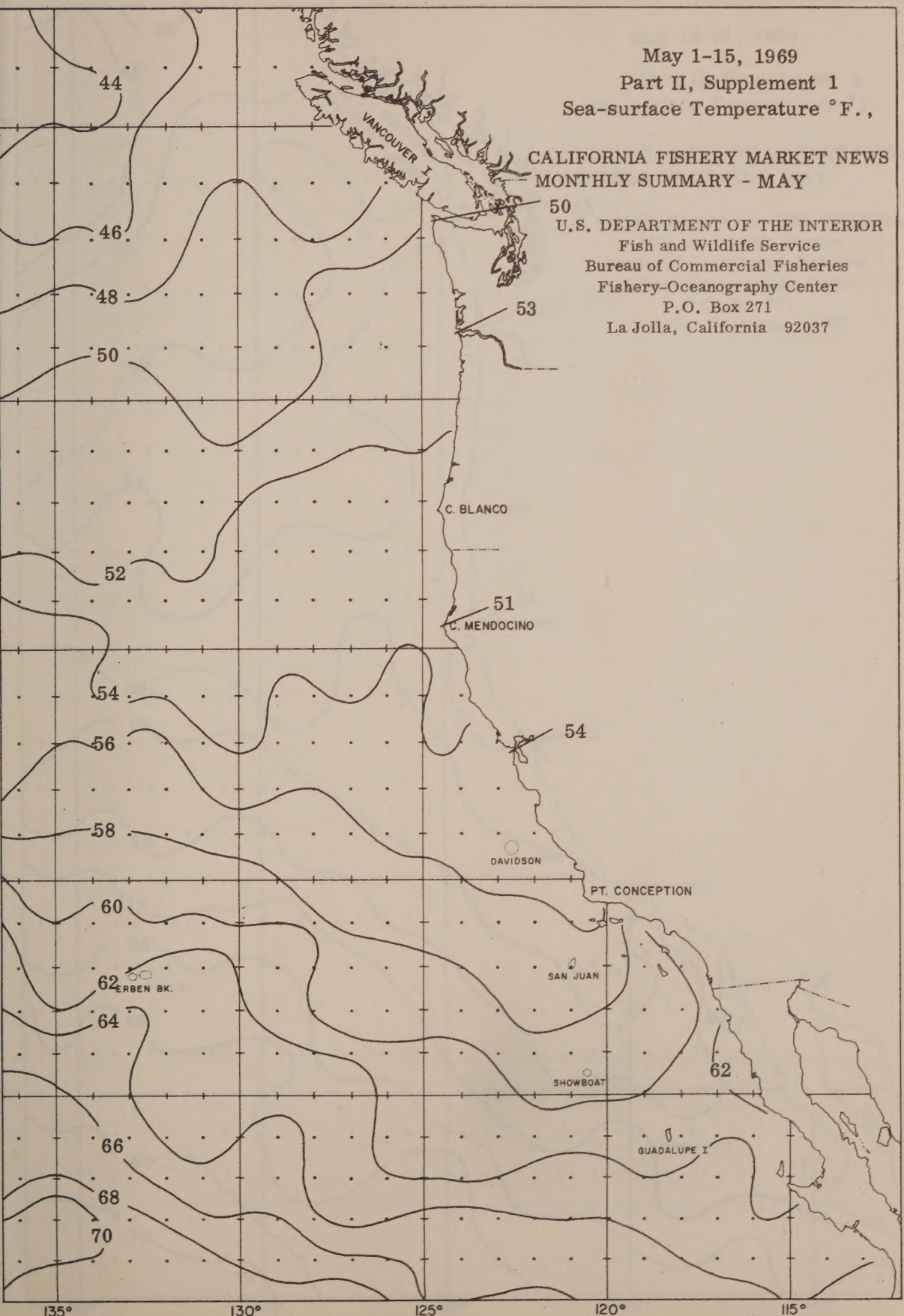

MAY 1-31, 1969
FIG. 2 - DEVIATION OF SEA SURFACE TEMP. (°F.) FROM LONG TERM MEAN. HATCHED AREAS COLDER IN 1969.
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2

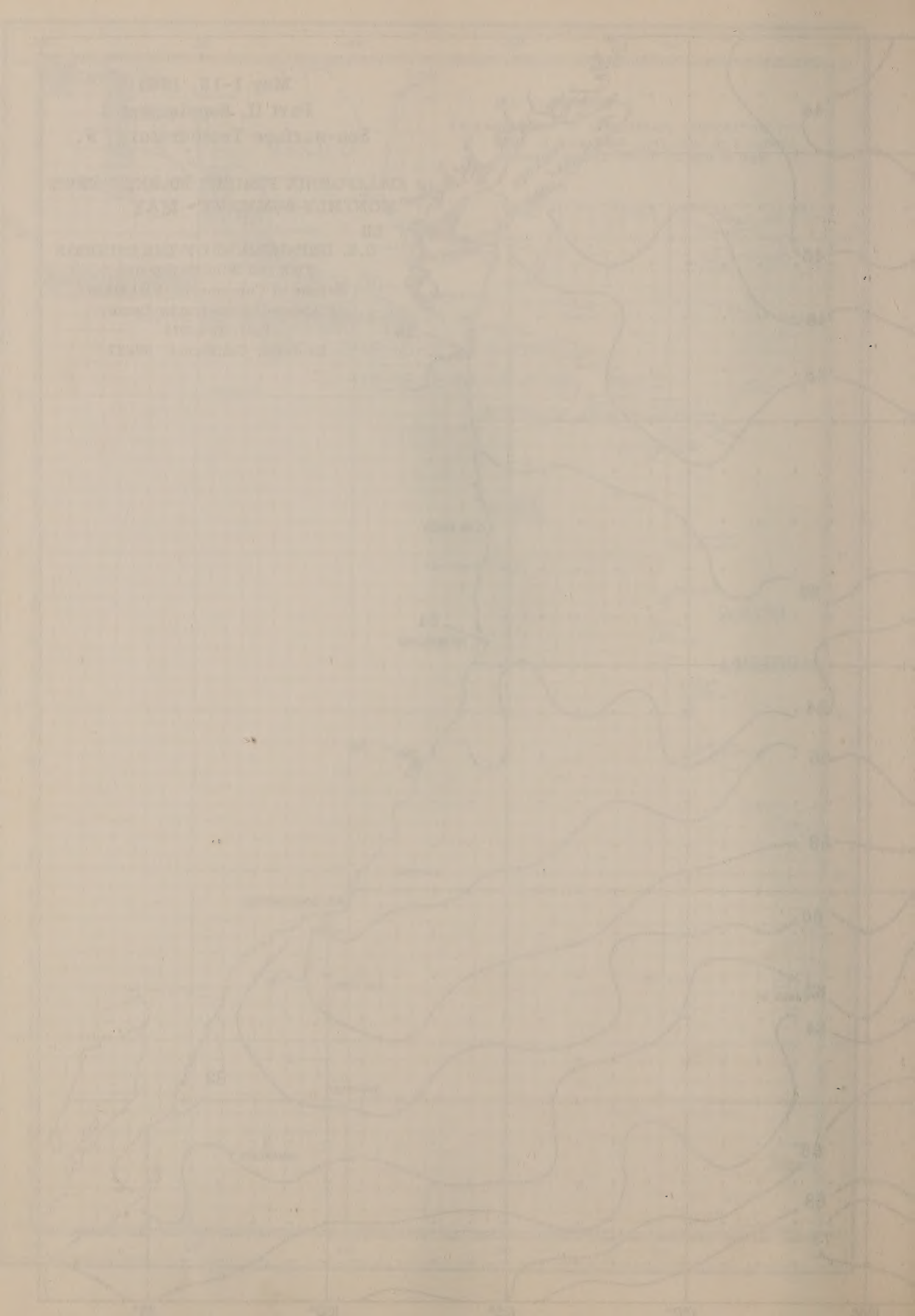

MAY 1-31, 1969
FIG. 3- DEVIATION OF SEA SURFACE TEMP. (°F.) FROM MAY 1968. HATCHED AREAS COLDER IN 1969.
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°

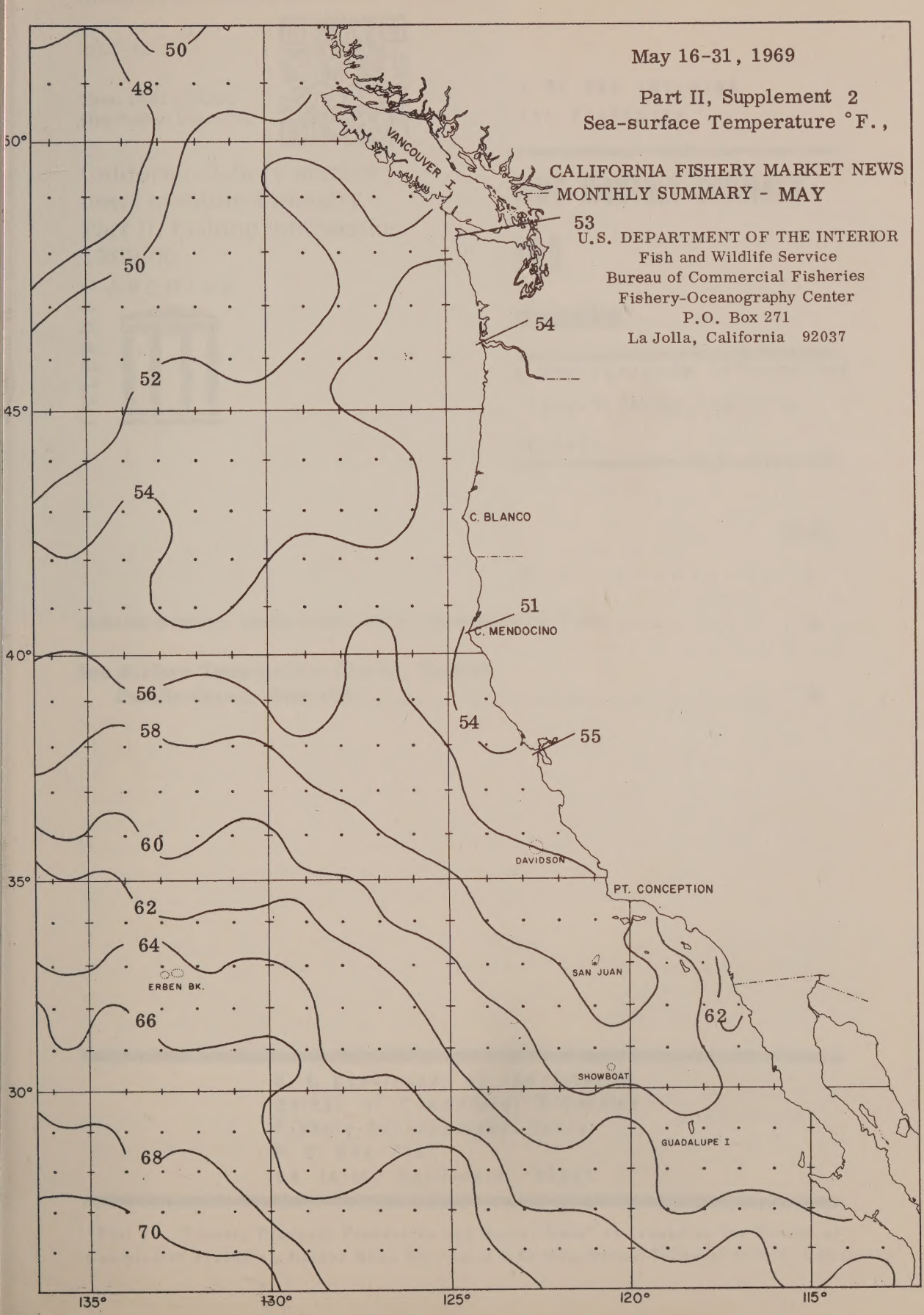

MAY 1-31, 1969
FIG. 4 - SEA SURFACE TEMPERATURES (°F.) BY 1-DEGREE SQUARES.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF MEXICO
HAWAIIAN ISLANDS
TUAMOTU ARCHIPELAGO
SAMOA ISLANDS
COOK ISLANDS
TONGA ISLANDS
PHOENIX ISLANDS
LINE ISLANDS
MARQUESAS
180°
170°
160°
150°
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
30°
40°


MAY 1-31, 1969
FIG. 5 - DEVIATION OF SEA SURFACE TEMPERATURE (°F.) FROM MAY 1968 BY 1-DEGREE SQUARES. SHADED AREAS COLDER IN 1969.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF CALIFORNIA
GULF OF PANAMA
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
YUCATAN
CUBA
HAITI
JAMAICA
GALAPAGOS IS
Guaymas
Alamos
Mazatlan
San Blas
C Corrientes
Revilla Gigedo Is
Acapulco
Salina Cruz
Champerico
San Jose
La Union
Corinto
Managua
Punta Arenas
Colon
Panama
Chippertim I
Coops I
Esmeraldas
C San Francisco
Guayaquil
Lobitos
Paita
Matacaballo
Eten
Salaverry
Trujillo
Chimbote
Lima
Callao
Hablanaves
Pisco
Chala
Mollendo
Arica
Iquique
Antofagasta
Coquimbo
Juan Fernandez
Valdivia
Sala y Gomez
S Felix
S Ambrosio
Progreso
Campeche
Vera Cruz
Tampico
Galveston
Belize
Trujillo
Puerto Limon
Bocas del Toro
Cartagena
Barranquilla
Maracaibo
Aruba
Curacao
Jamaica
Kingston
Port au Prince
Santiago
Guantanamo
Habana
Cabo Gracias a Dios
Corinto
Managua
San Juan del Norte
Bahia Salinas
Bahia Culebra
Las Perlas
Chiriqui
Pta Garachine
Pta Mala
Pta Parinas
Pta Aguja
Pta Pariñas
Pta Chipana
Pta Lobos
Pta Patillos
Pta Lobos
Pta Negra
Pta Lobos
Pta Copaca
Pta Lobos
Pta Lobos
Pta Lobos


MAY 1-31, 1969
FIG. 6 - DEVIATION OF SEA SURFACE TEMPERATURE (°F.) FROM 12 YEAR MEAN (1947-1958) BY 2-DEGREE SQUARES. SHADED AREAS COLDER IN 1969.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF CAMPECHE
GALAPAGOS IS
Guaymas
Alamos
Mazatlan
San Blas
Corrientes
Revilla Gigedo Is
Salina Cruz
GUATEMALA
HONDURAS
Champerico
San Jose
Le Union
NICARAGUA
Cormito
Managua
Punta Arenas
COSTA RICA
Colon
Panama
Cocos I
Esmeraldas
San Francisco
Guayaquil
Lobitos
Eten
Salaverry
Trujillo
Chimbote
Lima
Callao
Pisco
Chala
Mollendo
Arica
Iquique
Antofagasta
Valdivia
30°
20°
10°
0°
120°
110°
100°
90°
80°
70°


May 1-15, 1969
Part II, Supplement 1
Sea-surface Temperature °F.,
CALIFORNIA FISHERY MARKET NEWS
MONTHLY SUMMARY - MAY
U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037
VANCOUVER I.
C. BLANCO
C. MENDOCINO
DAVIDSON
PT. CONCEPTION
SAN JUAN
SHOWBOAT
GUADALUPE I.
ERBEN BK.
44
46
48
50
52
54
56
58
60
62
64
66
68
70
50
53
51
54
62
135°
130°
125°
120°
115°




May 16-31, 1969
Part II, Supplement 2
Sea-surface Temperature °F.,
CALIFORNIA FISHERY MARKET NEWS
MONTHLY SUMMARY - MAY
U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037
50
48
50
52
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54
51
54
55
62
VANCOUVER I
C. BLANCO
C. MENDOCINO
DAVIDSON
PT. CONCEPTION
SAN JUAN
SHOWBOAT
GUADALUPE I
ERBEN BK.
50°
45°
40°
35°
30°
135°
130°
125°
120°
115°